DOCUMENT RESUME

ED 220 521 TM 820 539

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TITLE The Development of an Instrument to Measure Creative Teaching Abilities.
PUB DATE Feb 82
NOTE 24p.; Paper presented at the Annual Meeting of the Southwest Educational Research Association (Austin, TX, February, 1982).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Competency Based Teacher Education; *Creative Teaching; Creativity; Divergent Thinking; Higher Education; Professional Development; Teacher Education; *Teacher Evaluation; Teaching Methods; *Test Construction
IDENTIFIERS *Creative Teaching Dilemma; Torrance Tests of Creative Thinking

ABSTRACT

The development of an instrument to measure creative teaching abilities, the Creative Teaching Dilemma (CTD), involved three phases. The instrument was constructed and refined, and scoring procedures were outlined. The activities comprising the CTD included defining the teaching dilemma, gathering additional facts, identifying and stating the problem, generating solutions, selecting criteria, evaluating alternative solutions, and stating the final solution. The reliability of scoring procedures was measured and one aspect of criterion-related validity was assessed in phase two. A second measure of criterion validity was taken in phase three. The results demonstrated acceptable reliability and validity estimates. After comparing CTD with the Torrance Tests of Creative Thinking Demonstrator Form (TTCTDF), it was concluded that the two instruments measured different aspects of the same abilities. The use of the CTD may provide a broader assessment of teaching performance. The abilities measured by CTD could be enhanced through training in creative problem solving. The instrument was developed to evaluate facets of competency based teacher education programs. (DWH)

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The Development of an Instrument to Measure Creative Teaching Abilities

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Paper presented at the Annual Meeting of the
Southwest Educational Research Association
Austin, Texas
February, 1982

TM 820535

The Development of an Instrument to Measure Creative Teaching Abilities

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In recent years, competency-based teacher education (CBTE) programs have emphasized the performance of specific, observable behaviors and defined competent teaching in terms of those behaviors. Development of these abilities may be an important aspect of teacher preparation. To meet the demands of a particular situation, a beginning teacher may develop a teaching style by modifying, adapting, elaborating, and synthesizing such behaviors. In this paper, this process is defined as creative teaching, and the development of an instrument to measure creative teaching abilities, the Creative Teaching Dilemma (CTD), is described.

The Problem

In using competency statements to evaluate the classroom performance of teachers, it has been pointed out that "a high score on any competency is no guarantee that the teacher would have performed in this manner had there not been an assessment; or that the teacher will consistently perform in this manner in the future (Capie, Anderson, Johnson, & Ellett, 1979; pp. 8-9)." In addition, classroom observation instruments are limited in the number of competencies that can be assessed (Capie, Anderson, Johnson, & Ellett, 1979). Therefore what is measured

by these instruments is a teacher's ability to perform certain competencies during a given lesson.

A typical classroom may present the teacher with a set of diverse, seemingly irreconcilable problems which require a number of diverse, perhaps contradictory solutions. In this setting, the teacher is called upon to apply previously acquired information in new ways. Torrance and Myers (1970) describe this process as a unique invention.

> This unique invention of the teacher emerges through the creative process of trying to accomplish important goals. As you fail or succeed in these goals, you become aware of your deficiencies, defects in your techniques and strategies, and gaps in your knowledge. You draw upon your past experiences. You intensify your search for clues in your ongoing experiences. You try to apply creatively the scientifically developed principles you have learned in your professional education or through your reading. Then, you read and study some more. You see things of which you have hitherto been unaware. You make or formulate hypotheses concerning ways of teaching. You test or modify these hypotheses and tell others what you have learned.(p. 102)

In order to define and measure creative teaching, specific creative abilities must be identified, and assessed in an instructional context. For Guilford (1956), the essence of creativity is divergent thinking -- the kind of

thinking in which "there is much searching or going off in various directions. This is most clearly seen when there is no unique conclusion"(p. 274). Divergent thinking consists of four factors: fluency, or production of ideas; flexibility, or ability to think of things in new ways; originality, or the production of unusual solutions to problems; and elaboration, the amount of detail provided (Guilford, 1967). Measurement of these abilities has provided the basis for Torrance's creativity tests, and for recent attempts to measure creativity in teaching. Two studies are of particular interest.

In the first study, Rosenberger (1978) attempted to measure the effects of training in divergent thinking strategies on the creative thinking and classroom performance of student teachers. She reported significant treatment effects on the Torrance Tests of Creative Thinking (TTCT). Subjects trained in divergent thinking strategies had statistically significantly higher scores on verbal and figural forms of the TTCT. However, there were no significant differences on teaching performance ratings by the cooperating teacher and university supervisor. The study thus failed to demonstrate a connection between creative thinking abilities and classroom teaching performance.

In the second study, Hutchins (1979) trained prospective teachers in Creative Problem Solving, and measured differences in performance on two hypothetical problems, one instructional and one disciplinary in nature. Measures

of fluency and originality, but not flexibility, were taken. However, no pilot study was undertaken to indicate the reliability and validity of the measures.

The shortcomings in these two studies provided the direction for the present study. Rosenberger's study indicates that an intermediate measure, one that is related to both creative abilities and classroom teaching performance, is needed. Hutchins recognized this need, but did not provide empirical data regarding the reliability and validity of her measures. The instrument described in this paper was designed to provide a reliable measure which demonstrated criterion-related validity; i.e., significant relationships with measures of creative thinking and with measures of classroom teaching performance. Therefore, the following research question guided the development of this instrument:

> What is the relationship between scores on the Creative Teaching Dilemma and scores on measures of creative thinking and of classroom teaching performance?

Methods

The development of this instrument involved three phases. In Phase One, the instrument was constructed and refined, and scoring procedures outlined. In Phase Two, reliability of scoring procedures was measured, and one aspect of criterion-related validity was assessed.

In Phase Three, a second measure of criterion-related validity was taken. Each phase of the study is described next.

Phase One

The activities in the CTD were based in part on an exercise entitled "Application Test: Creative Learning and Teaching," developed and used by Torrance in his classes in creative thinking. The CTD consists of eight activities. Each of these activities is described in brief.

1. The Dilemma. Subjects are asked to read a one-page description of a hypothetical situation faced by an imaginary beginning teacher. The dilemma was constructed by interviewing teachers, university professors, and undergraduates in education, regarding their experiences with problems in the classroom. From the problems supplied by these resources, a narrative was composed.

2. Additional Facts. After reading the dilemma, subjects are given the opportunity to supply any missing information that they believe would be helpful as they try to solve the dilemma. This activity is designed to allow subjects to individualize the situation to some degree, based on their perceptions and experiences. It is intended that they supply facts, not additional problems or possible solutions at this point.

3. Problem Identification. In this activity subjects are given five minutes to list as many problems as they

can from the dilemma. They are allowed to refer to the dilemma in making their lists. The time limit was imposed to facilitate scoring of this activity.

4. Problem Statement. From the list of problems they generate, subjects select and synthesize one problem that forms the essence of the dilemma. This problem should be stated as a question, so that solutions will consist of answers to the qusstion.

5. Generating Solutions. For ten minutes, subjects list as many alternative solutions as possible to the problem they have stated. Again, the time limit was imposed to facilitate scoring of this activity.

6. Selecting Criteria. Subjects select five criteria with which to evaluate their solutions. They are encouraged to select criteria that will help them discriminate between solutions, and that are relevant to the teaching situation.

7. Evaluation of Alternative Solutions. The five most promising solutions are selected informally for evaluation by the subjects. Each criterion is used to rank all five solutions, with a score of 5 given to the best solution according to that criterion, down to a score of 1 for the poorest solution on that criterion. After all criteria have been applied, totals for each solution indicate the overall evaluation.

8. Statement of the Final Solution. Based on the evaluation, subjects either restate their best solution,

or combine ideas into an "even better" solution.

For the purposes of the present study, only the Problem Identification and Generating Solutions activities have been scored. Procedures for scoring other actitities provide a direction for future research. Two dimensions, fluency and flexibility, are scored for each activity. In each case, the fluency score is the total number of appropriate, unrepeated responses within respective time limits. Problem fluency is a measure of a subject's ability to identify and state problems within a situation. Solution fluency measures the abiiity to produce alternative solutions to a stated problem.

Flexibility scores are measures of shifts in thinking, and the ability to approach a situation from different points of view. Problem flexibility indicates the ability to identify different kinds of problems in a situation, and solution flexibility measures a similar ability in proposing alternative solutions.

A preliminary form of the CTD was administered to ten graduate students in education at the University of Georgia. Following this administration, they discussed their reactions with the researcher, and made suggestions for the modification of the CTD. A number of changes were made in the directions and organization of the instrument as a result of this information.

Next, scoring procedures for each dimension of the CTD were developed. Fluency scoring involved determining

the number of responses to each activity. A potential problem involved scoring when subjects responded in paragraph or narrative form rather than with a list. In this case, each new idea was scored as a separate response. In addition, when subjects provided several responses under one major heading, as in an outline, each was scored as a separate response.

Scoring flexibility involved the establishment of a system for measuring shifts in thinking and different approaches to a situation. Torrance (1974) has used categories for responses, and derived flexibility scores by counting the number of categories used by each respondent. This procedure was followed here.

A complete list of problems in the CTD was submitted to a panel of experienced teachers, each holding at least a Masters degree and having at least three years of classroom teaching experience. Each judge was asked to categorize the problems, with no limitations on the number of categories or the size of each category. From the five independent groupings, a set of eleven problem categories was developed, using the "best fit" of all five. The judges approved the final problem categorization scheme.

In order to follow a similar procedure in developing solution flexibility categories, a body of alternative solutions was developed from preliminary administrations of the CTD. Solution categories were developed in the same manner as problem categories. Thirteen solution

categories emerged from this process.

Phase Two

In Phase Two, the interscorer reliability of the CTD was assessed, and the relationship between CTD scores and teaching performance was investigated. Using the categories developed in Phase One, complete scoring instructions for the CTD were developed. Five raters were given written instructions for scoring the fluency dimension of the CTD. Each rater scored five tests selected at random from a pilot sample. Each rater assigned a fluency score to the Problem Identification and Generating Solutions activities of the CTD. Scores were correlated using the Pearson product-moment correlation.

The same five raters were given written instructions for scoring the flexibility dimension of the CTD. Each rater scored five tests selected at random from the pilot sample, and assigned a flexibility score to the Problem Identification and Generating Solutions activities. The scores were correlated using the Pearson product-moment correlation.

In addition to correlating flexibility scores, a measure of the reliability of the categorization system was taken, using the percentage of agreement for each response. Agreement in this case means that the response is placed in the same flexibility category by different raters.

The second goal of this phase was to investigate the predictive validity of the CTD for teaching performance.

specifically for classroom management and problem solving. The measure of teaching performance used with both student teachers and beginning teachers in the state of Georgia is the Teacher Performance Assessment Instrument (TPAI), a classroom observation instrument. Its reliability and validity have been well-documented (Capie, Ellett, & Johnson, 1979; Ellett, Capie, & Johnson, 1980). Within the TPAI, a classroom management factor has been identified (Tobin, Capie, Ellett, & Johnson, 1980), and this factor was used as the indicator of ability in classroom management and problem solving for this study. From the set of factor score coefficients derived from orthogonal factor analysis, a classroom management score may be derived for a subject.

Classroom management scores were derived in this manner for 33 student teachers in Early Childhood Education (K-4) at the University of Georgia. Ratings of these student teachers were made by a university supervisor trained in the use of the TPAI. Using the Pearson product-moment correlation, classroom management scores were correlated with subjects' scores on the CTD.

Phase Three

In Phase Three, the relationship between scores on the CTD and measures of creative thinking was investigated. Fifty-eight undergraduates majoring in Early Childhood Education at the University of Georgia served as subjects for this phase. These subjects were all enrolled in the second quarter junior year methods course in Early Childhood Education.

The Torrance Tests of Creative Thinking Demonstrator Form (TTCTDF) was used to measure creative thinking. The TTCTDF provides verbal and figural creativity scores in a streamlined format, using activities similar to previous Torrance creativity tests. One major advantage is the reduced time of administration -- approximately 20 minutes. Another is the possibility of gathering both verbal and figural scores in so short a time.

Verbal tasks on the TTCTDF include product improvement, asking questions, just suppose, and unusual uses. Figural tasks involve incomplete figures and repeated figures.

Preliminary work with the TTCTDF has produced interrater reliabilities consistently above .90. A number of validity studies are now under way. Construct validity studies thus far completed are promising. (Torrance, 1980)

Subjects were administered the TTCTDF and the CTD. Scores were correlated using the Pearson product-moment correlation.

Results

Interscorer Reliability

Five raters were given written instructions for scoring each of the dimensions of the CTD. Scores were correlated using the Pearson product-moment statistic. Correlations for Problem Fluency and Solution Fluency were all 1.00. Correlations for Problem Flexibility ranged from .75 to .99,

with a mean correlation of .90. Correlations for Solution Flexibility ranged from .64 to .87, with a mean correlation of .78. Correlation matrices are in Tables 1-2.

Table 1

Interrater Reliability Correlations for Problem Flexibility Scores of the CTD

Rater #	1	2	3	4	5
1		.89	.89	.90	.98
2			.75	.81	.85
3				.99	.95
4					.96

Note: $\bar{X}_r$ = .90

Table 2

Interrater Reliability Correlations for Solution Flexibility Scores of the CTD

Rater #	1	2	3	4	5
1		.85	.79	.81	.81
2			.80	.87	.64
3				.78	.73
4					.71

Note: $\bar{X}_r$ = .78

Percentage of agreement in categorizing responses was also measured. Percentage of agreement for Problem Flexibility bility ranged from 65.0 to 81.7, with a mean percentage of agreement of 73.7. Percentage of agreement for Solution Flexibility ranged from 71.6 to 91.9, with a mean percentage of agreement of 78.6. Tables 3-4 contain the percentage of agreement matrices.

Relationship Between the CTD and Teaching Performance

Using the Pearson product-moment correlation, the CTD scores of 33 student teachers at the University of Georgia were correlated with classroom management scores derived from the TPAI, a classroom observation instrument used to assess beginning teachers in the state of Georgia. Four correlations were derived in this manner. Of the four, only Solution Fluency (r = .39; df = 31; $p < .05$) reached statistical significance. Correlations for all dimensions of the CTD are presented in Table 5.

Relationship Between the CTD and Creative Thinking

The CTD scores of 58 undergraduates majoring in Early Childhood Education at the University of Georgia were correlated with their scores on the Torrance Tests of Creative Thinking Demonstrator Form (TTCTDF), a measure of creative thinking. Sixteen correlations were derived. The correlation between CTD Problem Fluency and TTCTDF Verbal Fluency reached statistical significance (r = .41; df = 56;

Table 3

Percentages of Agreement for Categorizing Problem Responses to the CTD

Rater #	1	2	3	4	5
1		80.0	71.7	71.7	81.7
2			71.7	65.0	75.0
3				78.3	71.7
4					70.0

Note: $\bar{X}_g = 73.7$

Table 4

Percentages of Agreement for Categorizing Solution Responses to the CTD

Rater #	1	2	3	4	5
1		91.9	71.6	81.1	77.0
2			75.7	82.4	77.0
3				77.0	74.3
4					78.4

Note: $\bar{X}_g = 78.6$

$p < .01$). The relationship between CTD Solution Fluency and TTCTDF Verbal Fluency was also statistically significant ($r = .60$; $df = 56$; $p < .01$).

There was a statistically significant correlation between CTD Problem Flexibility and TTCTDF Verbal Fluency ($r = .31$; $df = 56$; $p < .05$). The relationship between CTD Solution Flexibility and TTCTDF Verbal Fluency was statistically significant ($r = .42$; $df = 56$; $p < .01$). Other correlations did not reach statistical significance. These correlations are presented in Table 6.

Table 5

Correlations Between CTD Variables and Classroom Management on the TPAI

	Problem Fluency	Solution Fluency	Problem Flexibility	Solution Flexibility
TPAI Classroom Management	.06	.39*	-.06	.11

* p .05; $df = 31$

Table 6

Correlations Between CTD Variables and TTCTDF Dimensions

	Problem Fluency	Solution Fluency	Problem Flexibility	Solution Flexibility
TTCTDF Verbal Fluency	.41**	.60**	.31*	.42**
TTCTDF Figural Fluency	.10	.26	.17	.19
TTCTDF Verbal Flexibility	.12	.17	.21	.17
TTCTDF Figural Flexibility	.23	.19	.25	-.04

* $p < .05$; df = 56

** $p < .01$; df = 56

Discussion

While the CTD has demonstrated acceptable reliability and validity estimates, more work with it is needed. For example, based on similar work done by Torrance (1974), scorers could be provided with oral as well as written directions for scoring. This might improve the interrater reliability for the flexibility measures in the CTD.

Development of scoring procedures for originality and elaboration could give a more complete picture of creative teaching abilities. Originality and elaboration measures could be provided for the Problem Identification and Generating Solution activities. Once sufficient data are collected, original or statistically infrequent responses could be determined and used to score an originality dimension. Torrance (1968) has outlined a procedure for determining elaboration scores on verbal tests. It involves counting the number of additional details used to elaborate an idea, without rewarding wordiness.

Scoring procedures for other activities in the CTD could also be developed. For example, points could be awarded for combining ideas, both at the problem statement stage and in the final solution. This type of scoring could be handled in the same way as the "Checklist of Creative Strengths" in the streamlined scoring procedures of the TTCT (Torrance & Ball, 1980). Evaluating the appropriateness of criteria used would present a challenge, but a measure of this type would be valuable in training and assessing teachers.

Beyond these considerations, it is valuable to return to the research question used to guide the development of the CTD:

> What is the relationship between scores on the Creative Teaching Dilemma and scores on measures of creative thinking and of classroom teaching performance?

The relationship between CTD scores and measures of creative thinking was statistically significant in four cases. TTCTDF Verbal Fluency was moderately correlated with each of the four CTD dimensions. After closely examining both instruments, it is concluded that the TTCTDF called for more divergent thinking, while the CTD elicited thinking that was more convergent in nature, due to the nature of the task. But it can also be concluded that the two instruments are measuring slightly different aspects of the same abilities.

The Solution Fluency dimension of the CTD also showed a moderate correlation with a measure of classroom performance, the classroom management factor of the TPAI (r = .39). There is apparently a relationship between the ability to generate alternate solutions to a problem and the ability to manage a classroom successfully. Again, the magnitude of the relationship indicates that there are other factors involved. Yet these two relationships, when taken together, imply that there is a connection between creative thinking abilities and classroom teaching performance, and that the CTD provides a first step toward measuring these abilities.

Use of the CTD may help to provide a broader assessment of teaching performance. Additional research by Riley (1980) indicates that the abilities measured by the CTD can be enhanced through training in Creative Problem Solving and similar programs. Inclusion of programs of this nature may begin to extend teacher training and evaluation beyond the level of minimum competence.

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